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**Fixed Radio Systems;
Characteristics and requirements
for point-to-point equipment and antennas;
Part 4: Antennas**

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Contents

Intellectual Property Rights 5

Foreword 5

Modal verbs terminology 5

1 Scope 6

2 References 6
2.1 Normative references 6
2.2 Informative references 7

3 Definitions, symbols and abbreviations 7
3.1 Definitions 7
3.2 Symbols 7
3.3 Abbreviations 7

4 Technical requirements specifications 7
4.1 Introduction 7
4.2 Templates for definition of Radiation Pattern Envelope (RPE) classes 8
4.3 Environmental profile 11
4.4 Radiation Pattern Envelope (RPE) 11
4.4.1 Introduction 11
4.4.2 Frequency range 0: 1 GHz to 3 GHz 12
4.4.3 Frequency range 1: 3 GHz to 14 GHz 16
4.4.4 Frequency range 2: 14 GHz to 20 GHz 19
4.4.5 Frequency range 3: 20 GHz to 24 GHz 22
4.4.6 Frequency range 4: 24 GHz to 30 GHz 25
4.4.7 Frequency range 5: 30 GHz to 47 GHz 28
4.4.8 Frequency range 6: 47 GHz to 66 GHz 32
4.4.9 Frequency range 7: 66 GHz to 86 GHz 35
4.5 Cross-Polar Discrimination (XPD) 38
4.5.1 XPD categories 38
4.5.2 XPD category 1 39
4.5.3 XPD categories 2 and 3 39
4.5.3.1 Frequency range 1 GHz to 3 GHz 39
4.5.3.2 Frequency range 3 GHz to 86 GHz 39
4.6 Antenna gain 41

5 Testing for compliance with technical requirements 41
5.1 Environmental conditions for testing 41
5.2 Wide radio-frequency band covering antennas specification and tests 41

Annex A (informative): Additional information 42

A.1 Mechanical characteristics 42
A.1.1 Environmental characteristics 42
A.1.2 Wind ratings 42
A.1.3 Antenna stability 42

A.2 Antenna input connectors 43

A.3 Return loss at the input ports 43

A.4 Inter-port isolation 43

A.5 Antenna labelling 43

Annex B (informative): Antenna gain and radiation pattern information 44

B.1 Impact of antenna gain on the frequency planning 44

B.2 Gain and typical radiation pattern for circular-symmetric antennas 44

History 46

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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 4 of a multi-part deliverable covering the Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas. Full details of the entire series can be found in ETSI EN 302 217-1 [2].

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document defines the characteristics and requirements of antennas for point-to-point radio equipment operating in the frequency range from 1 GHz to 86 GHz falling within the scope of ETSI EN 302 217-2 [i.4].

For technical commonalities that range is here divided into sub-ranges as follows:

Range 0: 1 GHz to 3 GHz;

Range 1: 3 GHz to 14 GHz;

Range 2: 14 GHz to 20 GHz;

Range 3: 20 GHz to 24 GHz;

Range 4: 24 GHz to 30 GHz;

Range 5: 30 GHz to 47 GHz;

Range 6: 47 GHz to 66 GHz;

Range 7: 66 GHz to 86 GHz.

The present document is applicable to fixed radio equipment with *integral* or *dedicated antennas*, and to *stand-alone antennas*. In the latter case the present document may be used to provide guidance as to the information to be supplied by a manufacturer as required by article 10 paragraph 8 of Directive 2014/53/EU [i.2].

The main body of the present document specifies the characteristics that define the various antenna classes, whilst the annexes provide additional information that is useful to both antenna manufacturers and user/installers.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 301 126-3-1 (V1.1.2): "Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures".

[2] ETSI EN 302 217-1 (V3.0.5): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system-independent common characteristics".

[3] IEC 60154-1: "Flanges for waveguides. Part 1: General requirements".

[4] IEC 60154-2: "Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides".

[5] IEC 60169-1: "Radio-frequency connectors. Part 1: General requirements and measuring methods".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Void.

[i.2] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC .

[i.3] Void.

[i.4] ETSI EN 302 217-2 (V3.0.8): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2: Digital systems operating in frequency bands from 1,3 GHz to 86 GHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

[i.5] Void.

[i.6] ETSI EN 301 126-1: "Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures".

[i.7] Recommendation ITU-R F.699: "Reference radiation patterns for fixed wireless system antennas for use in coordination studies and interference assessment in the frequency range from 100 MHz to about 70 GHz".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 302 217-1 [2] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 302 217-1 [2] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 302 217-1 [2] apply.

4 Technical requirements specifications

4.1 Introduction

The electrical characteristics are given as function of specific classification of the antennas according to the principles referred to in clause 4.2.

The antenna manufacturer shall state, for each antenna type, the frequency band of operation and antenna gain at least at the frequency band edges and at mid-band. An antenna, which employs a radome, shall meet the requirements of the present document with the radome in place. The antenna system shall radiate a linear (single or dual) polarized wave.

4.2 Templates for definition of Radiation Pattern Envelope (RPE) classes

The RPE directional characteristic (co-polar and cross-polar) impacts the interference situation in the network planning and a trade-off between a highly demanding RPE and the cost/size/weight of the antennas, compatible with the constraints given by present and future networks is then advisable.

With respect to the Radiation Pattern Envelope (RPE), four classes (RPE classes 1 to 4) have been identified according maximum co-polar limit templates for any actual RPE mask in significant range of off-axis azimuth angles. The templates for subdivision in those classes are also depending on given frequency ranges of operation according to figures 1 to 4 and table 1.

When more than one actual standardized RPE falls within the same class template, a sub-class indicative (A, B, C, etc.) shall be used according their more demanding RPE limit in angles closer to the intended direction.

NOTE: Figures 1 to 4 report limit templates for any actual RPE mask of classes 2, 3 and 4 antennas; class 1 antennas are defined as those which actual RPE mask exceeds class 2 limit template.

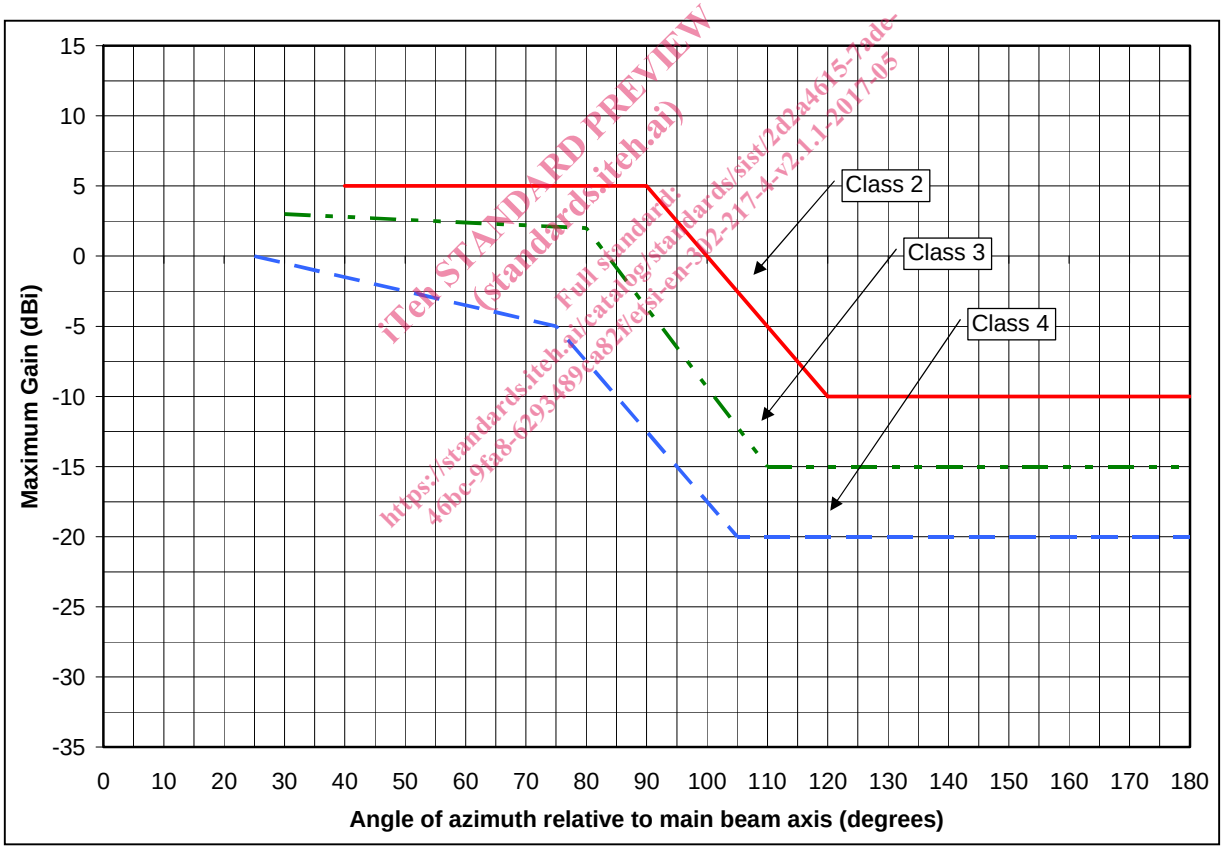


Figure 1: Co-polar limit templates for actual RPE masks of antenna classes in the range 1 GHz to 3 GHz (see table 1)

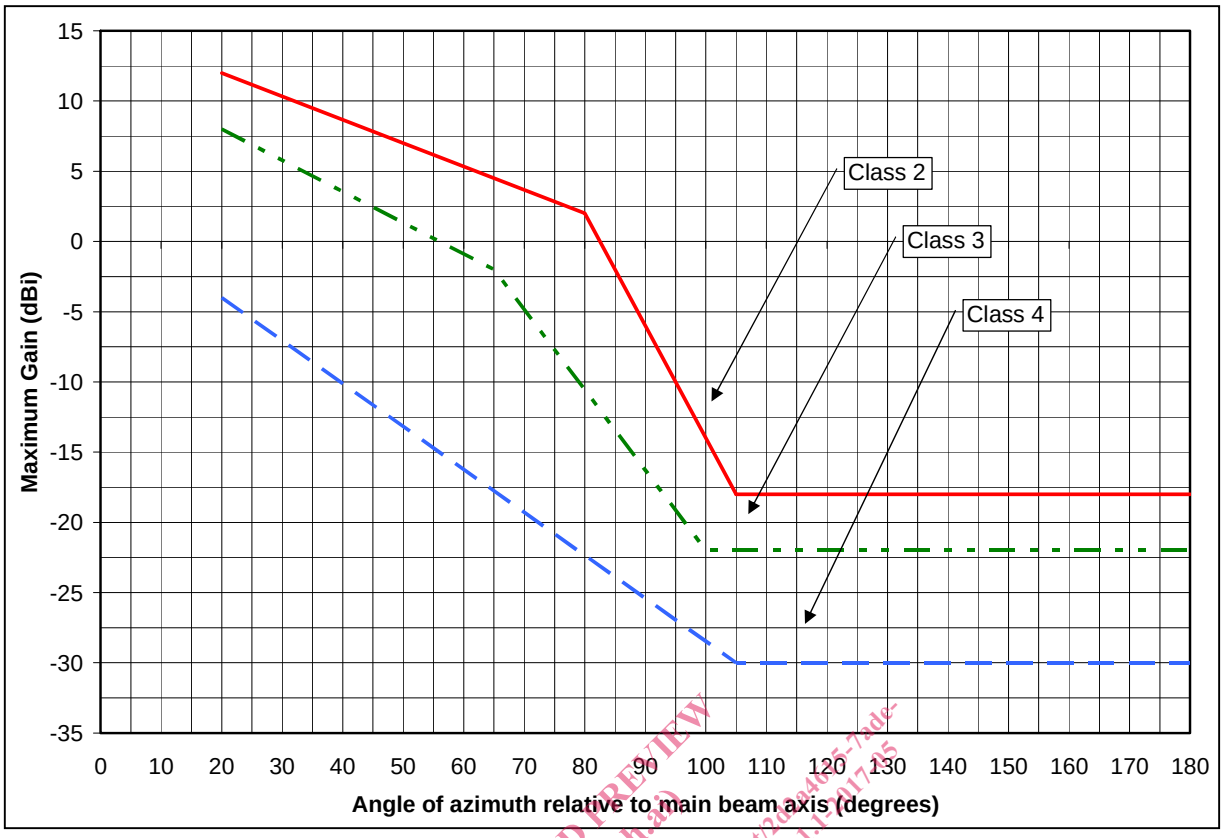


Figure 2: Co-polar limit templates for actual RPE masks of antenna classes in the range 3 GHz to 30 GHz (see table 1)

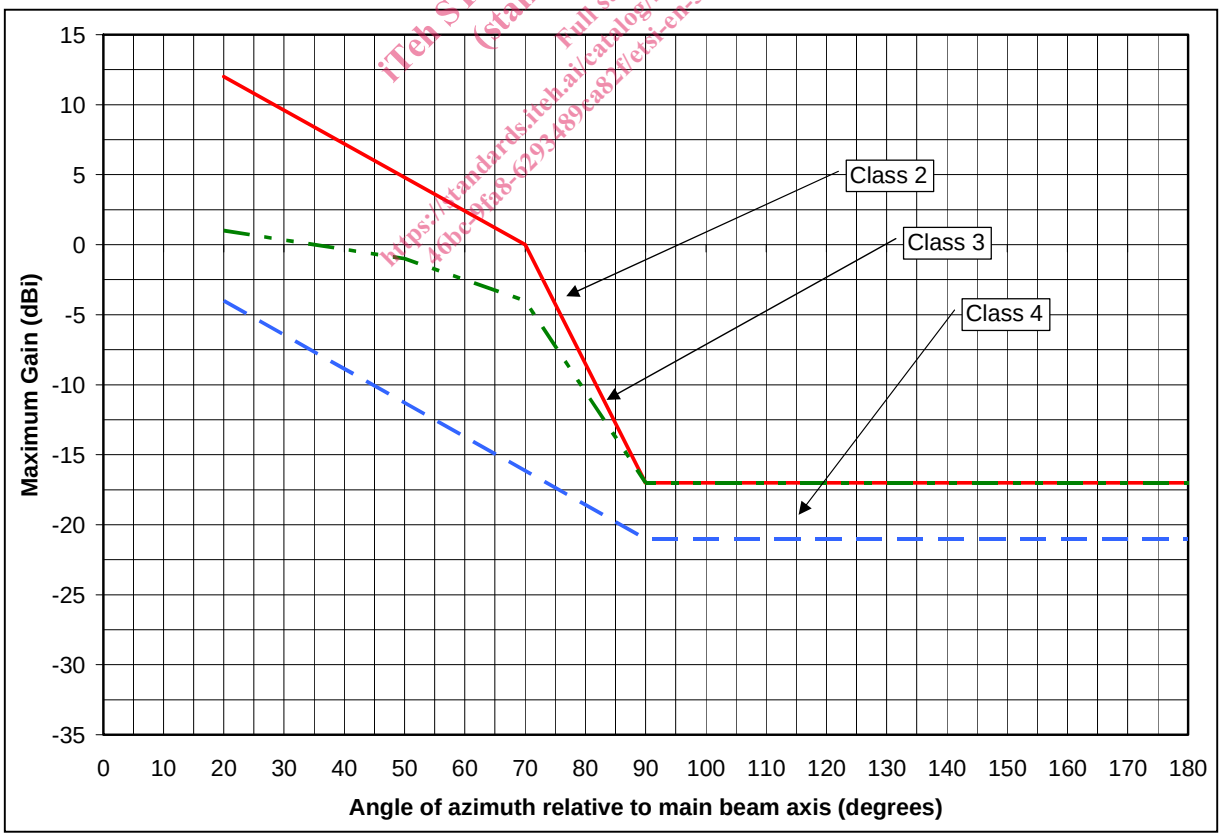


Figure 3: Co-polar limit templates for actual RPE masks of antenna classes in the range 30 GHz to 66 GHz (see table 1)

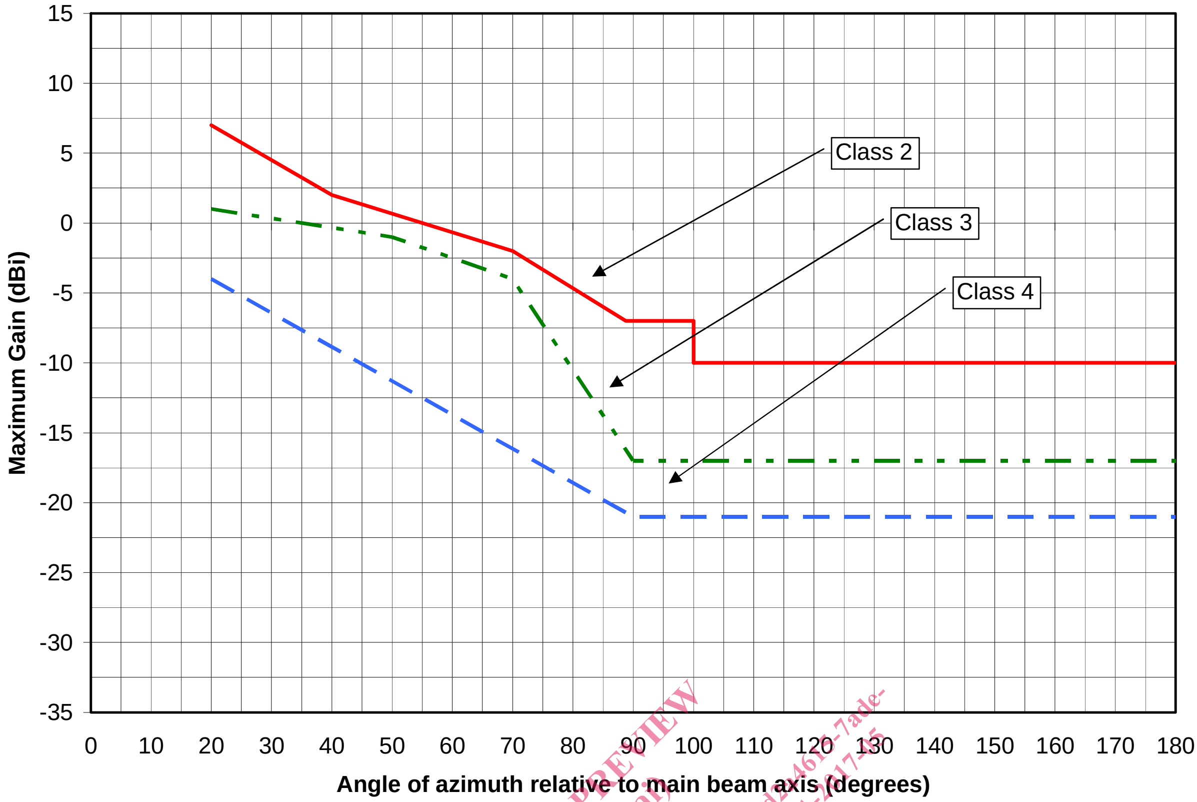


Figure 4: Co-polar limit templates for actual RPE masks of antenna classes in the range 66 GHz to 86 GHz (see table 1)

Table 1: Corner points of co-polar limits for actual RPE templates (see figures 1, 2, 3 and 4)

RPE classes (see note 1)	Co-polar maximum limit templates for actual RPEs							
	Range 1 GHz to 3 GHz (see note 2)		Range 3 GHz to 30 GHz		Range 30 GHz to 66 GHz (see note 3)		Range 66 GHz to 86 GHz	
	Azimuth angle (°)	Maximum gain (dBi)	Azimuth angle (°)	Maximum gain (dBi)	Azimuth angle (°)	Maximum gain (dBi)	Azimuth angle (°)	Maximum gain (dBi)
2	40	5	20	12	20	12	20	7
	90	5	80	2	70	0	40	2
	120	-10	105	-18	90	-17	70	-2
	180	-10	180	-18	180	-17	88,75	-7
							100	-7
							100	-10
							180	-10
3	30	3	20	8	20	1	20	1
	80	2	65	-2	50	-1	50	-1
	110	-15	100	-22	70	-4	70	-4
	180	-15	180	-22	90	-17	90	-17
					180	-17	180	-17
4	25	0	20	-4	20	-4	20	-4
	75	-5	105	-30	90	-21	90	-21
	105	-20	180	-30	180	-21	180	-21
	180	-20						

NOTE 1: Class 1 antennas are defined as those which actual RPE exceeds class 2 template limit.
NOTE 2: No specific class 4 antenna RPE is defined for this frequency range; the corresponding limit template in table 1 is set for possible future use.
NOTE 3: No specific class 4 antenna RPE is defined for the frequency range 47 GHz to 66 GHz; the corresponding limit template in table 1 is set for possible future use.

4.3 Environmental profile

The required environmental profile for operation of the antenna or the equipment-antenna assembly (in case of systems with integral antenna) shall be declared by the manufacturer. The antenna shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile. For testing the compliance to technical requirements refer also to ETSI EN 301 126-3-1 [1] and clause 5 in the present document.

4.4 Radiation Pattern Envelope (RPE)

4.4.1 Introduction

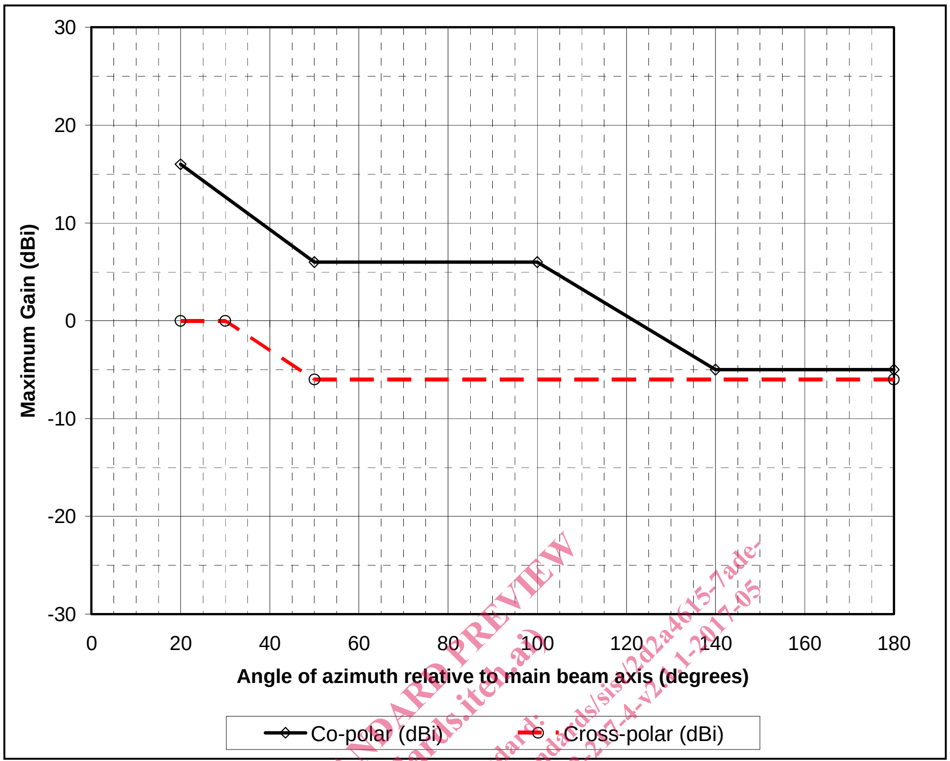
The present document defines all currently available Antenna RPE classes. An overview of which is given in Table 2.

Table 2: Summary of RPE classes represented in the present document

Frequency range (GHz)	Antenna Radiation Pattern Envelope (RPE) class
1 to 3	1A, 1B, 1C, 2, 3
3 to 14	1, 2, 3, 4
14 to 20	1, 2, 3, 4
20 to 24	1, 2, 3, 4
24 to 30	1, 2, 3, 4
30 to 47	1, 2, 3A, 3B, 3C, 4
47 to 66	1, 2, 3A, 3B
66 to 86	1, 2, 3, 4

4.4.2 Frequency range 0: 1 GHz to 3 GHz

The choice of antenna depends on the application planned for this band, requirements of the operators and the responsible administration. Figures 5 to 10 give the RPEs for antenna classes 1, 2 and 3.



Angle (°)	Co-polar (dBi)	Angle (°)	Cross-polar (dBi)
20	16	20	0
50	6	30	0
100	6	50	-6
140	-5	180	-6
180	-5		

Figure 5: Class 1A antenna RPE (1 GHz to 3 GHz)